Climate data

Heiko Fechner

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1. Overview

There are two basic kinds of climate data in DELPHIN:

- 1. Location data
- 2. Climate components (single climate data)

1.1. Location data

These data are intended to represent the climate at a particular location. They are combined in one file, which may contain the following climate components:

- temperature
- relative humidity
- diffuse solar radiation on a horizontal surface
- direct solar radiation
- longwave atmospheric counter radiation
- wind speed
- wind direction
- rain flow density
- atmospheric pressure

Furthermore, this file must contain information about the location. These are e.g.:

- country
- city or location
- longitude
- latitude
- altitude

DELPHIN normally uses climate files in its own format c6b. Furthermore files in epw and wac format can be read.

1.1.1. c6b format

The c6b format is a binary format which can contain all climate components mentioned above. There is also the possibility that single components can contain no or invalid data. For editing such files the free tool CCMEditor is available. This program can be downloaded here https://www.bauklimatik-dresden.de/downloads.php?aLa=en . With the help of this program the data can be changed or new data can be added. It can also read various other formats such as epw, wac, TRY 2017. There is also an import wizard for text via the clipboard with which other text-oriented formats can be read in (text files, Excel, etc.). In the c6b format the direct solar radiation is stored as solar normal radiation. If the original data contains the radiation on a horizontal surface, it will be converted, considering the geographical location. You can find an online help for this tool here: https://www.bauklimatik-dresden.de/ccmeditor/help/en/ index.html.

1.1.2. epw format

EPW is the abbreviation for *Energy Plus Weather*. This format was developed in the USA primarily for use with the EnergyPlus software. However, it is now also used by a variety of other building simulation programs. It is a text-based format that contains the data as commaseparated columns. Here is an example of the beginning of such a file:

LOCATION, Brussels Natl AP, BRU, BEL, ISD-TMYX, 064510, 50.90100, 4.48400, 1.0, 56.19
DESIGN ·CONDITIONS,1,2017 ·ASHRAE ·Handbook · ·Fundamentals ·- ·Chapter ·14 ·Climatic ·Design ·Information,,Heating
TYPICAL/EXTREME 'PERIODS, 6, Summer - Week 'Nearest 'Max 'Temperature 'For 'Period, Extreme, 9/16, 9/22, Summer - Week
GROUND TEMPERATURES, 3, .5, ,, , 4.89, 4.30, 5.35, 6.99, 11.28, 14.60, 16.83, 17.51, 16.35, 13.78, 10.34, 7.15, 2, ,, ,7.07, (
HOLIDAYS/DAYLIGHT SAVINGS, No, 0, 0, 0, 0
COMMENTS 1, "NCEI ISD - + #years=[15] · Period · of · Record=2003-2017; · Jan=2004; · Feb=2004; · Mar=2011; · Apr=2003; · May
COMMENTS ·2, "Downloaded from Climate.Onebuilding.org Ground temps represent undisturbed earth temperatu
DATA PERIODS, 1, 1, Data, Sunday, 1/·1, 12/31¶
2004,1,1,1,1,60,?9?9?9?9E0?9?9?9?9?9?9?9?9?9?9?9?9?9?9*9*9*9*9*9,0.0,-0.9,93,101625,0,0,265,0,0,0,0,0,0,0,150,2.
2004,1,1,2,60,?9?9?9?9E0?9?9?9?9?9?9?9?9?9?9?9?9?9?9?9
2004,1,1,3,60,?9?9?9?9E0?9?9?9?9?9?9?9?9?9?9?9?9?9?9*9*9*9*9*9,-1.3,-2.5,90,101403,0,0,261,0,0,0,0,0,0,0,140,2
2004,1,1,4,60,?9?9?9?9E0?9?9?9?9?9?9?9?9?9?9?9?9?9?9*9*9*9*9,-0.8,-3.0,83,101295,0,0,263,0,0,0,0,0,0,0,140,5

Figure 1. epw example

You can find a description for all elements of this format among others here: https://climate.onebuilding.org/papers/EnergyPlus_Weather_File_Format.pdf.

Both DELPHIN and the CCMEditor can read this format directly. But this is only possible if this file contains data for one year as hourly values. Different time periods are possible but rare. Files of this format normally also do not contain rain, which is why it is only conditionally suitable for hygrothermal calculations. In the following, the most important columns for DELPHIN are shown with the corresponding climate components:

- 0 start year
- 6 temperature
- 8 relative humidity
- 9 atmospheric pressure
- 12 atmospheric sky irradiation
- 14 direct solar radiation normal to the sun
- 15 diffuse solar radiation on a horizontal surface
- 20 wind direction

• 21 - wind speed

Columns 28 (precipitable water) or 32 (liquid precipitation depth) may contain rain.

1.1.3. wac format

The wac format (WUFI ASCII Climate) was developed by the Fraunhofer Institute for Building Physics in Holzkirchen (IBP) for data exchange with the software WUFI. It is a text format with flexible column structure. The columns are defined in the header. Here is an example:

WUFI®_WAC_02
10 Zeilenversatz zu 'Anzahl der Datenspalten'
GaasbeekSchloss
Alle Zeiten sind GMT, unabhängig von der tatsächlichen Zeitzone des Ortes.
4.19694444 Längengrad [°]; Osten ist positiv
50.79638889 Breitengrad [°]; Norden ist positiv
68.138 HöheAMSL [m]
0 Zeitzone [h von UTC]; Osten ist positiv
1 Zeitschritt [h]
271560 Anzahl der Datenzeilen
14 Anzahl der Datenspalten
ZEIT TA HREL ISGH ISD PSTA RN WD WS CI ILAH ILTH GT GR
2020-01-01 01:00 8.4 0.95 0 0 1010.5 0.0 211 2.9 0.98 318 320 8.2 0.13
2020-01-01 03:00 8.8 0.94 0 0 1010.7 0.3 203 2.9 1.00 345 322 8.7 0.13

Figure 2. wac format example

The following columns are possible

- ISGH global solar radiation on the horizontal surface
- ISDH direct solar radiation on the horizontal surface
- ISD diffuse solar radiation on horizontal surface
- ISM measured short-wave radiation on a given surface
- ILAH atmospheric counter radiation on horizontal surface
- ILTH terrestrial longwave radiation on horizontal surface
- ILM measured longwave radiation impact on a given surface
- CI occultation
- WS scalar mean value of wind speed
- WV vectorial mean value of wind speed
- WD wind direction
- RN rain on horizontal surface in one hour
- RM measured rain flow on a given area
- TA ambient temperature
- HREL relative humidity
- PSTA air pressure at station height

• PMSL - air pressure reduced to sea level

Since the wac format can contain rain, it is well suited as an interchange format. Furthermore, it can be generated by external tools like the *Meteonorm* software (https://meteonorm.com/) or the *Lokalklimagenerator* (https://wufi.de/de/2017/03/31/lokalklimagenerator/) of IBP.

1.2. Single climate data - climate components.

A climate component represents a single quantity. DELPHIN can use it as climate condition. Climate conditions can contain constant values, sinusoidal oscillations, external data sets, or external sources from an FMU. Climate conditions can be used in boundary conditions or field conditions.



Figure 3. Climate condition with one data set

A climate condition can read the following types of datasets:

- ccd format
- tsv format
- 2D DELPHIN output files as d6o or d6b

1.2.1. ccd format

The ccd format represents a single climate component as a time series in a text file. The following format is used:

comments

comments
Keyword Unit
dd hh:mm:ss value

Here is an example of a temperature:

Common file format
Air temperatures
Temperature C
0 0:00:00 -2
0 6:00:00 -4
0 10:00:00 4
1 00:00:00 -1
1 6:00:00 -4
.

The keyword in the header is used by DELPHIN to check the correct usage of the climate file. In the following tables you will find all currently available keywords.

Table 1. List	of all ke	ywords for	ccd - 1
---------------	-----------	------------	---------

Keyword	Explanation	Unit
Temperature	C	RelativeHum idity
relative humidity	%	VaporPressur e
Vapor Pressure	Ра	GasPressure
AirPressure	Ра	RainFluxNor mal
Rain Flow Density Normal to Surface	l/m2s	RainFluxHori zontal
Rain stream density on a horizontal surface	l/m2s	WindDirectio n
Wind Direction	Deg	WindVelocity
Wind Speed	m/s	SWRadiation Imposed
Shortwave Radiation Normal to Surface	W/m2	SWRadiation Direct
direct solar radiation to a horizontal surface	W/m2	SWRadiation Diffuse
diffuse solar radiation on a horizontal surface	W/m2	LWRadiation Flux
incident longwave radiation normal to the surface	W/m2	CloudCovera ge
Occultation	_	SkyTemperat ure
Sky Temperature	С	LWRadiation SkyEmission
longwave sky counterradiation	W/m2	LWRadiation GroundEmiss ion

Table 2. List of all keywords for ccd - 2

keyword	explanation	unit
PressureHead	PressureHead	m
SolutionConcentration	Solution concentration for salt (molality)	mol/kg
WaterFlux	Liquid Water Flow Normal to Surface	kg/m2s
HeatFlux	Heat flux normal to the surface	W/m2
VOCDensity	VOC density in the gas phase (concentration)	µg/m3
WaterSource	Liquid Water Production Rate	kg/m3s
EnergySource	Energy Source (Volume Source)	W/m3
VOCSource	VOC Source (Production Rate)	mg/m3s
FluidFlowRate	Volume flow rate for liquids or gases	m3/s
MassFlowRate	Mass Flow	kg/s
FluidChangeRate	Change rate for liquids or gases (air change rate)	1/s
Percentage	various fractions	%
HeatTransferCoefficient	Heat Transfer Coefficient	W/m2K
Power	Power	W
Velocity	Speed	m/s

If a climate dataset with a wrong keyword is assigned in Delphin, only a warning will be issued and the simulation will not be aborted. Please watch out for yellow text in the solver window (warnings). Such incorrect assignments should be corrected, because otherwise wrong results can occur.

1.2.2. tsv format

A tsv file is a special form of the well known csv file. There are only tabs as separators and only numbers are allowed as data. For DELPHIN to handle such a file correctly, the following format should be used:

```
time [unit] value1 [unit] ...
Time value1
...
```

There can be multiple value columns. The time column must always be the first one. The unit must be specified. The text in the column header of the values can be arbitrary but should reflect the type of data. DELPHIN does not evaluate keywords here and cannot check the correct usage. Here is an example:

```
Time [d] Temperature [C]
0 -2
0.2 -4
0.5 4
1 -1
1.4 -4
.
```

If more than one value column is specified, a selection box appears in the climate conditions dialog of DELPHIN (see below).

2. Use of climate data

Climate data are used in DELPHIN in two places:

- boundary conditions resp. surfaces
- Field conditions or sources/sinks

There are two types of use:

direct use without specification - surfaces in simple mode implicitly use climate conditions without specifying it separately. For outdoor climate, site data is taken and for indoor climate, constant values are applied or climate data is calculated using a model (adaptive models).

Use with indication of used climate component - Here climate conditions are used, which in turn can be assigned to boundary conditions or field conditions.



Figure 4. Scheme of climate data usage

The location data can be used directly in DELPHIN without sparate generation of climate conditions. To do so, select a dataset from the climate selection list, which starts with the text '*[Current location]::*' (see picture below).

Specification Name: Wall (vertical, facing west) 2:OutdoorHeatConduction Type: Heat conduction [HeatConduction] Schedule: <no always="" enabled="" schedule=""> Cimate data Temperature [Temperature] [Current location]::Temperature Imposed heat flux [HeatFlux] <select create="" new="" or=""> Wind velocity [WindVelocity] <select create="" new="" or=""> Create new> Create new> Create new> Create new> Create new> Solope coefficient for still air [W/m2K]: Exponent for moving air []:</select></select></no>	Boundary condition	? ×
Name: Wall (vertical, facing west) 2:OutdoorHeatConduction Type: Heat conduction [HeatConduction] Schedule: <no always="" enabled="" schedule=""> Cimate data Temperature [Temperature] [Current location]::Temperature Imposed heat flux [HeatFlux] <select create="" new="" or=""> Wind velocity [WindVelocity] <select create="" new="" or=""> Create new> Parameter Exchange coefficient for still air [W/m2K]: Slope coefficient for moving air []: Exponent for moving air []:</select></select></no>	Specification	
Type: Heat conduction [HeatConduction] Schedule: <no always="" enabled="" schedule=""> Create new Climate data Temperature [Temperature] [Current location]::Temperature Imposed heat flux [HeatFlux] <select create="" new="" or=""> Wind velocity [WindVelocity] <select create="" new="" or=""> Parameter Exchange coefficient for still air [W/m2K]: 25 Slope coefficient for moving air []:</select></select></no>	Name: Wall (vertical, facing west) 2:OutdoorHeatConduction	
Schedule: <no always="" enabled="" schedule=""> Climate data Climate data Temperature [Temperature] [Current location]::Temperature Imposed heat flux [HeatFlux] <select create="" new="" or=""> Create new> Wind velocity [WindVelocity] <select create="" new="" or=""> Parameter Exchange coefficient for still air [W/m2K]: Slope coefficient for moving air []: Exponent for moving air []:</select></select></no>	Type: Heat conduction [HeatConduction] Kind: Exchange coefficient [Exchange]	•
Climate data Temperature [Temperature] [Current location]::Temperature Imposed heat flux [HeatFlux] <select create="" new="" or=""> Create new Wind velocity [WindVelocity] <select create="" new="" or=""> Parameter Exchange coefficient for still air [W/m2K]: 25 Slope coefficient for moving air []: Exponent for moving air []:</select></select>	Schedule: <pre></pre> <pre>Schedule</pre>	Create new
Temperature [Temperature] [Current location]::Temperature Imposed heat flux [HeatFlux] <select create="" new="" or=""> Wind velocity [WindVelocity] <select create="" new="" or=""> Parameter Exchange coefficient for still air [W/m2K]: 25 Slope coefficient for moving air []: Exponent for moving air []: 25</select></select>	Climate data	
Imposed heat flux [HeatFlux] <select create="" new="" or=""> Wind velocity [WindVelocity] <select create="" new="" or=""> Parameter </select></select>	Temperature [Temperature] [Current location]::Temperature	Create new
Wind velocity [WindVelocity] <select create="" new="" or=""> Parameter </select>	Imposed heat flux [HeatFlux] <select create="" new="" or=""></select>	Create new
Parameter 25 Exchange coefficient for still air [W/m2K]: 25 Slope coefficient for moving air []: 1 Exponent for moving air []: 1	Wind velocity [WindVelocity] <pre><select create="" new="" or=""></select></pre>	Create new
Exchange coefficient for still air [W/m2K]: 25 Slope coefficient for moving air []: 5 Exponent for moving air []: 5	Parameter	
Slope coefficient for moving air []:	Exchange coefficient for still air [W/m2K]:	25
Exponent for moving air []:	Slope coefficient for moving air []:	
	Exponent for moving air []:	
		Cancel

Figure 5. Boundary condition with location data

Since DELPHIN version 6.1.3, you can also access all datasets created in surfaces implicitly in

this way. In this case, the name in the climate list is automatically composed of the name of the surface and a keyword. For example, in the image below, the dataset '*Inside Normal* +5:IndoorTemperatureWTA' is used for the air temperature. This means:

- the dataset is from a surface named 'Inside Normal +5 '
- this surface is of type indoor climate with subtype adaptive climate according to WTA 6.2
- it is a temperature

Name:	WTA source 1			
Гуре:	Moisture source due to air flow through leakages WTA 6.2 [ConvectiveSource]			~
Schedule:	<no schedule<="" th=""><th>/always enabled></th><th></th><th>Create new</th></no>	/always enabled>		Create new
limate dat	a			
Indoor air	temperature	Inside Normal +5:IndoorTemperatureWTA	~	Create new
Indoor rela	tive humidity	Inside Normal +5:IndoorRelativeHumidityW	TA ~	Create new
Outdoor ai	r temperature	[Current location]::Temperature	~	Create new
arameter				
Air permea	ince of the "mo	visture leaks" of the component [m3/m2hPa]:		0.00
leight of t	he continuous	air space in building [m]:		
Pressure di	ifference due t	o mechanical ventilation systems [Pa]:		

Figure 6. Field condition with use of implicit climate data of an indoor surface

Furthermore, climate data can also be configured in a climate condition, which can then be selected in a boundary or field condition.

lame:	in:IndoorH	leatConductionWTA				
ype:	Heat cond	uction [HeatConduction] · Kind: Ex	change coefficient [Exchange]			
chedule:	<no sched<="" th=""><th>lule/always enabled></th><th></th><th></th><th>~ Cr</th><th>eate new.</th></no>	lule/always enabled>			~ Cr	eate new.
imate dat	ita					
emperati	ure	in:IndoorTemperatureWTA			~	Edit
nposed h	heat flux	<select create="" new="" or=""></select>			✓ Cr	eate new
ind velo	city	<select create="" new="" or=""></select>			✓ Cr	eate new
acc flow	rato	collect or create new			× Cr	osto now
me: in:I	IndoorTempe	ratureWTA				×
cification me: in:In xe: Ten arnal data	ondition	ratureWTA emperature] gramming/Probleme/Belgien/Luc Vasseur/temp/climate/in_in	Kind: Data points [Tab door, T cod	pulatedData]	Import	×
cification me: in:In pe: Ten ernal data nate data	IndoorTempe mperature [Te a file options a file: G:/Pro	ratureWTA emperature] gramming/Probleme/Belgien/Luc Vasseur/temp/climate/in_ind	 Kind: Data points [Tab door_T.ccd 	oulatedData]	Import	×
cification me: in:I ernal data nate data erence:	IndoorTempe mperature [Te a file options a file: G:/Proje \${Proje @ Ref	ratureWTA emperature] gramming/Probleme/Belgien/Luc Vasseur/temp/climate/in_ind ect Directory}/climate/in_indoor_T.ccd erence with file path relative to project file	Kind: Data points [Tab door_T.ccd	oulatedData]	Import Edit	×
cification me: in:In pe: Ten ernal data nate data	IndoorTempe mperature [To a file options a file: G:/Pro \${Proje @ Ref Q Ref	ratureWTA emperature] gramming/Probleme/Belgien/Luc Vasseur/temp/climate/in_inuter ect Directory}/climate/in_indoor_T.ccd erence with file path relative to project file erence with path to user climate directory	V Kind: Data points [Tab door_T.ccd	oulatedData]	Import Edit	×
cification me: in:In pe: Ten ernal data nate data rerence:	IndoorTempe mperature [Tr a file options a file: G:/Proje @ Ref @ Ref @ Ref @ Ref	ratureWTA emperature] gramming/Probleme/Belgien/Luc Vasseur/temp/climate/in_ind ect Directory}/climate/in_indoor_T.ccd erence with file path relative to project file erence with path to user climate directory erence with absolute file path	V Kind: Data points [Tab door_T.ccd	oulatedData]	Import Edit	×
crification me: in:In pe: Ten ernal data mate data ference: Use linea	IndoorTempe mperature [Tr a file options a file: G:/Proje @ Ref @ Ref ar interpolatic	ratureWTA emperature] gramming/Probleme/Belgien/Luc Vasseur/temp/climate/in_ind ect Directory}/climate/in_indoor_T.ccd erence with file path relative to project file erence with path to user climate directory erence with absolute file path n 25	Kind: Data points [Tab door_T.ccd	pulatedData]	Import Edit	×

Figure 7. Boundary condition dialog with climate condition

In the image above, a climate condition named '*in:IndoorTemperatureWTA*' was created and then assigned to a boundary condition of type heat transfer as temperature. Such a boundary condition can then be used in a surface of the detailed type.

2.1. Climate conditions

A climate condition is a kind of container for climate data. The following types of data can be used here:

• constant values

Boundary condition

- simple sine oscillation
- two superimposed sine oscillations
- data sets from external files
- data transfer from a FMU (FMI coupling)

In principle, climate data from external files can be used in two ways:

- cyclic application climate data for one year can be repeated for any period.
- non-cyclic application data can be used only for the period in which they are given (mostly measured data).

When files are read in there are three types of links:

- reference to the path relative to the DELPHIN project (project-related data)
- reference to the path relative to the climate user database (database-related data)
- absolute file path (no reference)

External data file o	pptions	
Climate data file:	G:/Programming/Probleme/Belgien/Luc Vasseur/temp/climate/in_indoor_T.ccd	 Import
Reference:	\${Project Directory}/climate/in_indoor_T.ccd	Edit
	 Reference with file path relative to project file 	
	\bigcirc Reference with path to user climate directory	
	○ Reference with absolute file path	

Figure 8. References of climate files in a climate condition

If the climate file cannot be read, an error message is displayed in the chart area of the climate condition.

Climate condition	>
Specification Name: New climate condition Type: Air/gas/fluid change rate [FluidChangeRate]	 Kind: Data points [TabulatedData]
External data file options Climate data file: G:/temp/RelativeHumidity.ccd Reference: G:/temp/RelativeHumidity.ccd Reference with file path relative to project file Reference with path to user climate directory Reference with absolute file path Vuse linear interpolation Use constant extrapolation for values beyond defined time range Treat climate data as annual cyclic data 	Import Edit Error reading climate data file, error message was: Invalid time point (non monotonic increasing or duplicate time point in line # 38: 1 01:00:00 0.84

Figure 9. Climate condition with faulty climate file

In the image above, the error message says that the time points are not monotonically increasing. An incorrect value was found in line 38. The file can then be corrected by clicking on the '*Edit*' button in a text editor.

There are the following options:

• use linear interpolation

- for time values between two given points in time, the data is interpolated using a linear function.
- otherwise the step function is used not recommended
- use constant extrapolation
 - $\circ\,$ if a time value is outside the given time range (only if not cyclic), the new value is created from the last value
 - $\circ~$ otherwise the calculation aborts with an error message
- treat climate data as annually cyclic
 - must be switched on, if the climate data set for one year with hourly values is available and the simulation is longer than one year
 - Switched off for non-cyclic data sets to avoid errors
- Value shift
 - $\circ~$ shifts the whole dataset by the specified value
 - $\circ~$ can be used to create a simple extreme year
- Clip at minimum or maximum
 - If this option is checked, the data will be truncated at the specified value

✓ Use linear interpolation				
Use constant extrapolation for values beyond defined time range				
☑ Treat climate data as annual cyclic da	ata			
Value shift:	0	К		
	0	С		

Figure 10. Options in climate conditions part 1

If tsv files with multiple value columns have been read in, a selection dialog appears to choose which data set to use.



Figure 11. Climate condition with selection from tsv file

3. Handling of location data

The following image shows the location data selection in DELPHIN.



Figure 12. Location data view

This view is displayed when you click on the button marked with the red arrow in DELPHIN. It

is divided into several areas:

- Database selection tree view of the climate database for selection.
- Database properties changing the view, filtering
- Properties of the selected dataset geographic coordinates, comments
- View graphical representation of the most important data

In this view the following actions are possible:

- Selection of a location dataset from the internal database or the user database.
- Selection of an external file
- Selection '*no climate data*' for simulations without location data (e.g. recalculation of laboratory experiments).
- Adding a dataset to the user climate database.
 - from local file
 - from remote server
- View of table of all data with an option for export
- Editing the environment albedo
- Save selected dataset to different folder
- Climate data report (with printing and export)
- View of website with additional informations



Figure 13. Location selection dialog

The selection tree shows all locations in the internal database (black) and the user database (blue). When an element is selected, the data is displayed in diagrams to the right of it. Here you can also quickly check if all data is available. In the upper area (green box) there are three checkboxes for filtering the tree. These buttons represent the solar radiation, the long wave radiation and the driving rain. If a box is checked, only those data are displayed that also contain the mentioned climate component. Another control possibility is given by the color boxes. Each color here represents a climate component:

- Red temperature
- Blue relative humidity
- Yellow short-wave solar radiation
- Brown long-wave sky radiation
- Green rain

You can also import location data from an external file. To do this, select the tab '*climate data file*' at the top.

Delphin 6.1.3 - Dach Base 2_en.d6p File Edit View Window Tools Help Select climate data and location O No climate data Climate database Climate data file Data file path: Reference TextLabel Reference with file path relative to project file Reference with absolute file path

Figure 14. Select climate file

Here, as already described above, the formats c6b, epw and wac are possible. If the file can be read in, the data is displayed in the diagrams. There are two possibilities for the directory references:

- relative path to the project recommended.
- absolute path

At the bottom of the selection dialog additional information and setting options can be found.

Climate data description	Location	
Climate data from standard database. ^	Latitude [+9090 Deg]:	52.38
City/Country: Potsdam/Germany , Source:	Longitude [-180180 Deg]:	13.07
Longitude: 13.07 Deg , Latitude: 52.38 Deg , Elevation: 81 m	Time zone:	UTC +1 ~
Nordostdeutsches Tiefland Mecklenburg- Vorpommern (ohne Küstenbereich); Altmark	Albedo [01]:	0.2 🗸

Figure 15. Additional information about the location climate

The left side shows a description of the selected climate if it is included in the corresponding file. The right side shows the following data:

- The geographical data for the current climate location.
- The albedo for the shortwave reflection of the surrounding ground

3.1. Adding data to the user database

If location data from external sources are used frequently, it is recommended to add them to the user database. There are two possible sources:

• external file

• remote climate server

First click on the green plus button.

<u>F</u> ile	. Edi <u>t V</u> iew W <u>i</u> ndow <u>T</u> ools Reports <u>H</u> elp							
Û	$ullet$ Select climate data and location \odot No climate data							
	Climate database	Climate data file						
	💷 🗊 🗹 Solar radi	ation 🗆 Longwave	□ Driving rain	■ 🕂				
	 Europe 							
	✓ Belgium		Brussels					
	 Switzerland 							
			Zurich_Winter Zurich_Summer Davos_Winter					
	 Italy 							
			Ancona					
			Genova					
			Napoli					
M								

Figure 16. Start Adding data to the user database

Then a dialog (wizard) for adding climate data opens.

Remote File Climate file		Add climate data	
Climate file	Remote File		
Current user climate Name and category AFG_PAR_Bagram AfG_pAR_Bagram Bagram.AP Bagram.AP AFG_PAR_Bagram Country City Name and categories Bagram.AP Bagram.AP Germany Cermany Cottbus DEU_BB_Cottbus Europa Cottbus DEU_BB_Cottbus Europa Cottbus DEU_BB_Cottbus Europa Germany Fanachourg Cottbus DEU_BB_Cottbus Europa Obrich Balgarevo BGR_DO_Balgarevo France Fana AD_Paris-Vatry AP FRA_AO_Paris-Vatry Nordamerika Canadi Ontario Ottawa-Macdonald-Cartier Ottawa-Macdonald-Cartier Update Update Update Update Update Marcian Anaconald-Cartier Canadi Ontario Ottawa-Macdonald-Cartier Ottawa-Macdonald-Cartier Canadi Ontario Ottawa-Macdonald-Cartier Canadi Canadi Canadi Contario Ottawa-Macdonald-Cartier Canadi Contario Ottawa-Macdonald-Cartier Canadi Contario Canadi Contario Contario Contario Contario Contario Contario Contario	Climate file		
AFG_PAR_Bagram Asia * Afghanistan * Bagram.AP * Bagram.AP * AFG_PAR_Bagram * Europa * Germany * Brandenburg * Cottbus * Dulgana * Dobrich * Balgarevo BGR_DO_Balgarevo * France * Grand Est * Ontario * Ontario * Otawa-Macdonald-Cartier	Current user climate	Name and category	
	AFG_PAR_Bagram - Asia - Afghanistan - Bagram AP - Bagram.AP AFG_PAR_Bagram - Europa - Cottbus DEU_BB_Cottbus - Cottbus DEU_BB_Cottbus - Bulgaria - Dobrich - Balgarevo BGR_DO_Balgarevo BGR_DO_Balgarevo - France - Grand Est - Paris-Vatry.AP FRA_AO_Paris-Vatry - Nordamerika - Canada - Ontario - Ottawa-Macdonald-Cartier.Intl.AP CAN_ON_Ottawa-Macdonald-Cartier	Country City City Name and categories The categories will be used as directories. Maximum 4 categories are possible. Empty categories will not be used. Name Category 1 Category 2 Category 3 Category 4 Update	

Figure 17. Dialog for adding climate data to the user database

The marked tabs on the top allow the selection if the new dataset comes from an external file or from the remote server.

3.2. Add from file

Climate file /home/fechner/Delphin6/data/DB_climate/Europe/Belgium/Brussels.c6b Current user climate AFG_PAR_Bagram AFG_PAR_BAGRA AFG_PAR_BAGRA AFG_PAR_BA	
AFC_PAR_Bagram FEUropa Cermany Cottbus DEU_BB_Cottbus Belgium Brussels Bulgaria Dobrich Balgarevo BGR_DO_Balgarevo France Carand Est Paris-Vatry.AP FRA_AO_Paris-Vatry Nordamerika Canada Ontario Catagory 2 Belgium Bulgaria Category 3 Category 4 Category 4 Cat	

Figure 18. Completed dialog

One proceeds as follows:

- 1. Selection of the climate file in dialog box 1
- 2. Specification of country and city in the fields at 4
- 3. Tree diagram shows the classification of the new climate data set in the structure
- 4. Adjusting the classification structure by specifying categories and edit name at 5
- 5. Click on the button '*Update*' at 6 shows the updated tree structure.
- 6. Finish by clicking on '*Ok*'.

Since version 6.1.3, the climate data view is also updated afterwards and the new file is displayed. As formats are again c6b, epw and wac possible. If the file has another format, it must be converted before with the help of the CCMEditor.

3.3. Add from remote server

A climate data set can be downloaded from a remote server. Delphin automatically connects to this server when this dialog is opened. The address and access are fixed and cannot currently be changed. There are approx. 64000 climate data sets from all over the world on this server. The following structure is defined in the selection tree on the left:

- Continent
 - Country
 - Region
 - City
 - Climate data set

To import, select a climate data set and then click on the 'Add' button. If everything works correctly, a success message will appear.

Add climate data		×
Remote File	Data	
 Poland Portugal Romania San Marino Serbia Slovakia State and All an Mayen Sveden Viriand Viriand Viriand Viriand Viriand Viriand Sordand Aborgen Aborgen	Annual mean 7.50 C Annual rain su 904.00 L	temperature um
Selected GBR_SCT_Aviemore.030630_TMYx	Add	Cancel

Figure 19. Dialog for selecting a climate data set from the server

When a data set is selected, the annual mean temperature and the annual rainfall per square meter are displayed at the top left. You can add as many data records as you like. To complete the process, click on 'Cancel'. The selection dialog is then displayed again.

3.4. Table view

Since version 6.1.7 it is possible to display the climate data as a table. To do this, first select a data set and then click on the button for the table view.



Figure 20. Button for table view

This opens a dialog with a table view of all climate data. From this dialog you can copy the data to the clipboard and use it from there (e.g. in Excel).

Climate table view DE: Potsdam EN: Potsdam										
Copy to clipboard										
Date/Time	Temperature [C]	RelativeHumidity [%]	DirectRadiationNormal [W/m2]	DiffuseRadiationHorizontal [W/m2]	WindDirection [Deg]	WindVelocity [m/s]	LongWaveCounterRadiation [W/m2]	AirPressure [Pa]	Rain [l/m2h]	
01.01.2000 1:00:00	-2.60	93.00	0.00	0.00	230.00	5.70	251.00	100530.00	0.00	
01.01.2000 2:00:00	-3.90	89.00	0.00	0.00	240.00	5.70	275.00	101140.00	0.00	
01.01.2000 3:00:00	-4.60	90.00	0.00	0.00	260.00	5.70	281.00	101600.00	0.00	
01.01.2000 4:00:00	-3.90	95.00	0.00	0.00	270.00	5.70	281.00	101620.00	0.00	
01.01.2000 5:00:00	-3.30	97.00	0.00	0.00	280.00	5.50	283.00	101650.00	0.00	
01.01.2000 6:00:00	-2.90	98.00	0.00	0.00	270.00	5.00	286.00	101670.00	0.00	
01.01.2000 7:00:00	-2.00	99.00	0.00	0.00	280.00	5.00	290.00	101740.00	0.00	
01.01.2000 8:00:00	-1.50	99.00	0.00	0.00	280.00	5.00	274.00	101780.00	0.00	
01.01.2000 9:00:00	-1.20	99.00	0.00	11.00	260.00	5.00	275.00	101830.00	0.00	
01.01.2000 10:00:00	-0.60	98.00	0.00	44.00	260.00	5.00	278.00	101850.00	0.00	
01.01.2000 11:00:00	0.10	93.00	0.00	69.00	260.00	7.00	282.00	101850.00	0.00	
01.01.2000 12:00:00	0.50	89.00	0.00	92.00	260.00	7.00	284.00	101850.00	0.00	
01.01.2000 13:00:00	0.40	92.00	0.00	42.00	260.00	7.00	283.00	101790.00	0.00	
01.01.2000 14:00:00	0.90	93.00	0.00	33.00	260.00	8.00	304.00	101700.00	0.00	
01.01.2000 15:00:00	1.20	93.00	0.00	25.00	260.00	9.00	306.00	101640.00	0.00	
01.01.2000 16:00:00	1.50	91.00	0.00	6.00	260.00	9.00	307.00	101570.00	0.00	
01.01.2000 17:00:00	1.70	87.00	0.00	0.00	260.00	11.00	290.00	101510.00	0.00	
01.01.2000 18:00:00	1.80	85.00	0.00	0.00	260.00	12.00	290.00	101440.00	0.00	
01.01.2000 19:00:00	1.60	86.00	0.00	0.00	260.00	10.00	289.00	101370.00	0.00	
01.01.2000 20:00:00	1.80	86.00	0.00	0.00	260.00	11.00	309.00	101330.00	0.00	
01.01.2000 21:00:00	1.80	87.00	0.00	0.00	260.00	11.00	309.00	101270.00	0.00	
01.01.2000 22:00:00	1.70	87.00	0.00	0.00	260.00	12.00	308.00	101170.00	0.00	
01.01.2000 23:00:00	1.90	87.00	0.00	0.00	270.00	13.00	309.00	101060.00	0.00	

Figure 21. Table view

3.5. Further functions

The following buttons allow the functions:

- Copy data
- Climate data report
- Help
- Web page with additional information

	Copy to	eport Help OClimat	te Information Websit
review climate data			
Annual mean tempera	ture: 9.54 C		
Annual rain load:	471 l/m2a		
	47 1 91128		
	Temp	erature [C]	
40 -			
30			
		in an	
20 -			

Figure 22. Buttons for additional functions

When you click on the copy button, you will be asked to select a folder and a file name. The current climate data set is then copied to this folder. The Help button opens this tutorial on our website. Clicking on 'Web page with additional information' opens another page of our website with more information.

3.5.1. Climate data report

Click on the report button to open a preview of the climate data report.



Figure 23. Preview for climate data report

The preview dialog corresponds to that for the input and output data. It allows settings for viewing, printing and exporting to pdf. Here the climate data is displayed as diagrams plus some additional information.



Air pressure

Location (outdoor) climate additional information

Rain an wind data

	Total rain in mm/a	Mean wind speed in m/s
Total (horizontal rain)	471.3	4.0
North wall	22.4	2.5
East wall	86.2	4.0
South wall	119.2	3.8
West wall	243.6	4.5

Figure 24. Example for additional data - wind-rain table

4. Conclusion

More information about climate data can be found on our website:

https://www.bauklimatik-dresden.de/climatedata.php?aLa=en

There is also explained how the data of the new German test reference year 2017 can be included. However, since these data do not contain rain, they can only be used for hygrothermal simulations to a limited extent.

Furthermore there is our forum: Forum-FAQ_Climate